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USAF BIOENVIRONMENTAL NOISE HANDBOOK. VOLUME 33, C-131B IN-FLIG--ETC(U)  
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AMRL-TR-75-50-VOL-33

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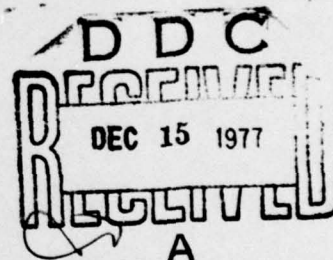


## USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

### Volume 33 C-131B IN-FLIGHT CREW NOISE

MARCH 1977

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AEROSPACE MEDICAL DIVISION  
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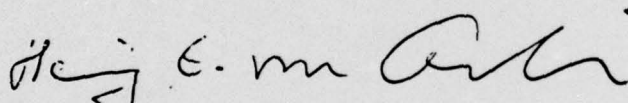
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FOR THE COMMANDER



HENNING L. VON GIERKE  
Director  
Biodynamics and Bionics Division  
Aerospace Medical Research Laboratory

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The C-131B is a USAF transport/passenger aircraft which can be used as a flying laboratory. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this aircraft during normal flight operations. Data are reported for 9 locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of		

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A personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application," AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

## PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 72310418, Measurement of Noise and Vibration Environments of Air Force Operations.

The author acknowledges the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.

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## INTRODUCTION

The C-131B is a USAF transport/passenger aircraft which can be used as a flying laboratory. This aircraft, which is manufactured by the General Dynamics Corporation, Convair Division, is powered by two R-2800-103W reciprocating engines rated at 2,500 hp (wet) at 2,800 rpm maximum take-off power. Each engine drives a Hamilton Standard Hydromatic (or Curtiss Electric) four-blade constant-speed, 4 m diameter propeller through a 0.45 gear reduction. The engines are manufactured by the Aircraft Corporation, Pratt & Whitney Aircraft Division.

This volume provides measured data defining the bioacoustic environments produced inside this aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the C-131B aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force Aircraft and aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. *Refer to Volume 1* (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

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## IN-FLIGHT NOISE

### MEASUREMENTS

All noise measurements were made on-board a standard-configured C-131B aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard C-131B environments but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at various flight crew and passenger locations. Table 1 lists the measurement locations and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone position was at ear level external to headgear in a region 0.2 — 0.3 meter from the head when an individual was present. At unoccupied locations, measurements were made at ear level throughout a volume where the head would normally be located. In both cases, the microphone was randomly moved throughout a spherical volume approximately 0.3 meter in diameter and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level which effectively smooths out short-duration fluctuations and best describes the exposure.

Although the presence of a crew member or passenger at a measurement location affects the resultant sound field, the magnitude of such effects is generally small and not significant in determining exposure limits or voice communication capabilities. Consequently, no distinction is made in this report between occupied and unoccupied measurement locations.

### RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the C-131B aircraft at the 9 specified locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These variety of measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1  
MEASUREMENT LOCATIONS AND TEST CONDITIONS

C-131B, Wright-Patterson AFB, 18 Jun 1975  
Serial # 53-7821

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Between Pilot and Copilot	Seated Head Level
2	Galley (Aisle Seat, Propeller Plane)	Seated Head Level
3	Front of Passenger Cabin — Left Side Window Seat	Seated Head Level
4	Front of Passenger Cabin — Left Side Aisle Seat	Seated Head Level
5	Middle of Passenger Cabin — Left Side Window Seat	Seated Head Level
6	Middle of passenger Cabin — Left Side Aisle Seat	Seated Head Level
7	Rear of Passenger Cabin — Left Side Window Seat	Seated Head Level
8	Rear of Passenger Cabin — Left Side Aisle Seat	Seated Head Level
9	Latrine — Right Side	Seated Head Level

CONDITION	DESCRIPTION
A	Two Engines — Taxi Power. 1000 RPM, 19" Manifold Pressure.
B	Takeoff — Wet, 2800 RPM, 62" Manifold Pressure, 104 KIAS.
C	Climb — 2600 → 2400 RPM, 51" → 40" Manifold Pressure, 150 KIAS.
D	Cruise — 2000 RPM, 30" Manifold Pressure, 160 KIAS, 4000 PA.
E	Approach — 2400 RPM, 26" Manifold Pressure, 150 → 120 KIAS.

[illegible]

TABLE: MEASURED SOUND PRESSURE LEVEL (D3)															IDENTIFICATION:														
OCTAVE BAND																													
NOISE SOURCE/SUBJECT:																													
( OPERATION:																													
C-131B AIRCRAFT															OMEGA 3.2														
INFLIGHT NOISE LEVELS															TEST 74-009-J01														
(															RUN 01														
(																													
(															04 MAR 77														
(																													
(															PAGE J1														
LOCATION/CONDITION																													
1/A		2/A		1/B		1/C		2/C		1/D		2/D		3/D		4/D		5/D		6/D		7/D		8/D		9/D		1/E	
FREQ																													
(HZ)																													
31.5		85	86	94	83	93	93	97	98	93	91	92	90	99	87														
63		87	90	100	105	94	93	100	102	99	94	97	93	98	100														
125		87	86	111	102	107	95	100	104	103	101	97	94	98	100														
250		79	76	104	93	98	90	93	95	95	99	101	96	97	91														
500		73	72	92	85	87	82	83	87	85	93	92	95	94	82														
1000		72	69	82	73	75	80	73	76	75	82	81	83	84	77														
2000		69	65	77	76	71	77	71	71	70	74	73	73	74	69														
4000		65	62	76	71	67	74	69	70	68	65	65	64	61	72														
8000		64	59	73	63	65	72	66	67	65	62	60	60	58	71														
OVERALL		92	93	112	103	110	99	104	107	105	103	103	101	104	104														



TABLE: MEASURES OF HUMAN NOISE EXPOSURE													IDENTIFICATION:
NOISE SOURCE/SUBJECT: ( OPERATION: )													OMEGA 3.2
C-131B AIRCRAFT ( )													TEST 74-009-001
INFLIGHT NOISE LEVELS ( )													RUN 01
( )													04 MAR 77
( )													PAGE H1
LOCATION/CONDITION													
1/A	2/A	1/B	1/C	2/C	1/D	2/D	3/D	4/D	5/D	6/D	7/D	8/D	9/D 1/E
HAZARD/PROTECTION													
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR													
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR													
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)													
NO PROTECTION													
OASLC	91	92	112	107	109	99	103	106	105	105	103	103	103
OASLA	78	76	99	90	93	87	88	91	90	94	94	93	88
T	960	960	36	170	101	285	240	143	170	85	85	101	240
MINIMUM QPL EAR MUFFS													
OASLA*	69	91	83	87	87	76	80	84	83	82	80	77	80
T	960	960	143	571	285	960	960	480	571	679	960	960	960
V-51R EAR PLUGS													
OASLA*	56	56	78	71	73	64	67	71	70	73	73	72	67
T	960	960	960	960	960	960	960	950	960	960	950	960	960
FLENTS EAR PLUGS													
OASLA*	57	57	79	72	75	66	69	72	71	74	73	72	69
T	960	960	960	960	960	960	960	960	960	960	960	960	960
H-157 IN-FLIGHT COMMUNICATION UNIT													
OASLA*	68	69	91	83	87	76	80	84	83	84	81	79	80
T	960	960	143	571	285	960	960	480	571	480	807	960	960
COMMUNICATION													
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)													
PSIL	72	69	84	73	78	80	76	78	77	83	84	84	78
ANNOYANCE													
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)													
TONE CORRECTION (C IN DB)													
PNLT	93	94	115	103	110	104	104	108	106	108	107	105	105
C	0	2	1	1	2	1	1	1	0	1	1	0	1

\* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

## REFERENCES

1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.